

**Claims:**

1. A process for preparing flexible polyurethane foam comprising the steps of:

5 A) providing a mixing apparatus capable of metering and mixing at least three separate reactive chemical component streams;

B) providing a first reactive chemical component stream consisting essentially of a TDI series isocyanate composition;

10 C) providing a second reactive chemical component stream comprising predominantly an MDI series isocyanate composition, on a weight basis;

D) providing a third reactive chemical component stream comprising at least one polyol; and

15 E) metering and mixing together the first, second and third reactive chemical component streams simultaneously by using the mixing apparatus under conditions suitable for the generation of flexible polyurethane foam.

20 2. The process according to Claim 1, wherein the process is a continuous process.

3. The process according to Claim 1, wherein the flexible polyurethane foam is produced under free-rise conditions.

25 4. The process according to Claim 1, wherein water is used as a blowing agent.

5. The process according to Claim 4, wherein the water is the  
30 sole blowing agent.

6. The process according to Claim 4, wherein the water is mixed with the at least one polyol.

7. The process according to Claim 1, wherein the second reactive chemical component consists essentially of MDI series isocyanates.

8. The process according to Claim 6, wherein the third reactive chemical component further comprises pre-mixed therein at least one catalyst for the reaction of isocyanates with active hydrogen compounds.

9. The process according to Claim 1, wherein 3 to 50 separate reactive chemical component streams are used.

10. The process according to Claim 1, wherein the MDI series isocyanate constitutes from 60 to 99% by weight of all the isocyanates used in the preparation of the flexible foam.

11. The process according to Claim 10, wherein the MDI series isocyanate comprises a combination of the 4,4'-; 2,4'-; and 2,2'-diphenylmethane diisocyanate isomers and higher functionality polyphenyl polymethylene polyisocyanates.

12. The process according to Claim 11, wherein the combination of 4,4'-; 2,4'-; and 2,2'- diphenylmethane diisocyanate isomers contains less than 5% by weight of the 2,2'-MDI isomer.

13. The process according to Claim 12, wherein the MDI series isocyanate composition contains less than 16% by weight of the 2,4'-MDI isomer, based on the total weight of the MDI series

isocyanate composition.

14. The process according to Claim 13, wherein the MDI series isocyanate composition contains less than 13% by weight of the 2,4'-MDI isomer, based on the total weight of the MDI series isocyanate composition.

15. The process according to Claim 14, wherein the MDI series isocyanate composition contains less than 7% by weight of the 2,4'-MDI isomer, based on the total weight of the MDI series isocyanate composition.

16. The process according to Claim 13, wherein the MDI series isocyanate composition contains from 51 to 87% by weight of the 4,4'-MDI isomer, based on the total weight of the MDI series isocyanate composition.

17. The process according to Claim 14, wherein the MDI series isocyanate composition contains from 59 to 81% by weight of the 4,4'-MDI isomer, based on the total weight of the MDI series isocyanate composition.

18. The process according to Claim 15, wherein the MDI series isocyanate composition contains from 65 to 81% by weight of the 4,4'-MDI isomer, based on the total weight of the MDI series isocyanate composition.

19. The process according to Claim 1, wherein the TDI series isocyanate is a mixture consisting essentially of from 65 to 80% of the 2,4-TDI isomer and from 35 to 20% of the 2,6-TDI isomer.

20. The process according to Claim 1, wherein the at least one polyol comprises at least one polyol selected from the group consisting of polyether polyols of equivalent weight 500 to 3000, polyester polyols of equivalent weight 500 to 3000, and mixtures of these.

21. A flexible foam prepared according to the process of Claim 1.

22. The flexible foam according to Claim 21, wherein the foam has a density in the range of from 23.55 kg/m<sup>3</sup> to 92.3 kg/m<sup>3</sup>.

23. The process according to Claim 1, wherein the MDI series isocyanate composition is a modified MDI isocyanate composition containing at least one member selected from the group consisting of urethanes, allophanates, biurets, uretonimines, carbodiimides, and isocyanurates; and further wherein the modified MDI isocyanate composition also contains from 16 to 30% by weight of isocyanate (NCO) groups.

24. The process according to Claim 1, wherein the second reactive chemical component consists essentially of an MDI series isocyanate composition.

25. The process according to Claim 24, further comprising a blowing agent consisting essentially of water, and wherein the MDI series isocyanate composition constitutes from 60 to 99% by weight of all isocyanates used in the preparation of the flexible foam.

26. The process according to Claim 25, wherein the amount of

the water in the flexible foam formulation composition ranges from 0.5 to 8.0 parts by weight, per 100 parts by weight of all polyols in the foam formulation (pphp).

5 27. The process according to Claim 26, wherein the Isocyanate Asymmetry Factor (IAF) of the foam formulation, calculated according to **Formula-I**, conforms to the following:

a) IAF ranges from 10 to 20, when the water content of the formulation is in the range of 0.5 to 2.0 pphp;

10 b) IAF ranges from 20 to 30, when the water content of the formulation is in the range of 2.0 to 3.0 pphp;

c) IAF ranges from 30 to 40, when the water content of the formulation is in the range of 3.0 to 4.0 pphp; and

15 d) IAF ranges from 40 to 50, when the water content of the formulation is in the range of 4.0 to 8.0 pphp;

wherein

**IAF** =  $100[(\text{pbw } 2,4'\text{-MDI in formulation})/125.2 + (\text{pbw TDI in formulation}/87)]/[\text{total -NCO equivalents in formulation}]$ ;

**Formula I.**

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28. The process according to Claim 27, wherein the ratio of the MDI series isocyanates to the TDI series isocyanates used in the preparation of the flexible foam can be changed without using any new chemical component streams and without changing the compositions of any of the existing chemical component streams.

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29. A foam prepared according to the process of Claim 28 which does not exhibit collapse or shrinkage during foaming, the foam having predominantly open cells upon reaching a tack-free state.

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30. The process according to Claim 1, wherein a combination of

blowing agents is used, said combination consisting essentially of water and one or more physical blowing agents selected from the group consisting of carbon dioxide, nitrogen, air, acetone, and pentane.

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31. The process according to Claim 30, wherein the one or more physical blowing agents is dissolved or dispersed into one or more of the said reactive monomer component streams.

10 ~~32~~. A process for preparing flexible polyurethane foam comprising the steps of:

A) providing a mixing apparatus capable of metering and mixing at least three separate reactive chemical component streams;

B) providing a first reactive chemical component stream consisting essentially of a TDI series isocyanate composition;

C) providing a second reactive chemical component stream consisting essentially of an MDI series isocyanate composition;

D) providing a third reactive chemical component stream comprising at least one polyol; and

E) metering and mixing together the first, second and third reactive chemical component streams simultaneously by using the mixing apparatus under conditions suitable for the generation of flexible polyurethane foam;

wherein the MDI series isocyanate consists essentially of a mixture of the 4,4'-; 2,4'-; and 2,2'-diphenylmethane diisocyanate isomers plus higher functionality polyphenyl polymethylene polyisocyanates, wherein

the mixture of diphenylmethane diisocyanate isomers contains less than 5% by weight of the 2,2'-MDI isomer relative to the total diphenylmethane diisocyanate isomer composition;

less than 16% by weight of the 2,4'-MDI isomer relative to the

total base MDI isocyanate composition; and  
the base MDI isocyanate contains from 51 to 87% by weight of the  
4,4'-MDI isomer relative to the total base MDI isocyanate  
composition.

100% 4,4'-MDI isomer relative to the total base MDI isocyanate composition.